

Supporting Information

For

**Modification of $Ti_3C_2T_x$ MXene with Hyperbranched Polyethylene Ionomers:
Stable Dispersions in Nonpolar/Low-Polarity Organic Solvents, Oxidation Protection,
and Potential Application In Supercapacitors**

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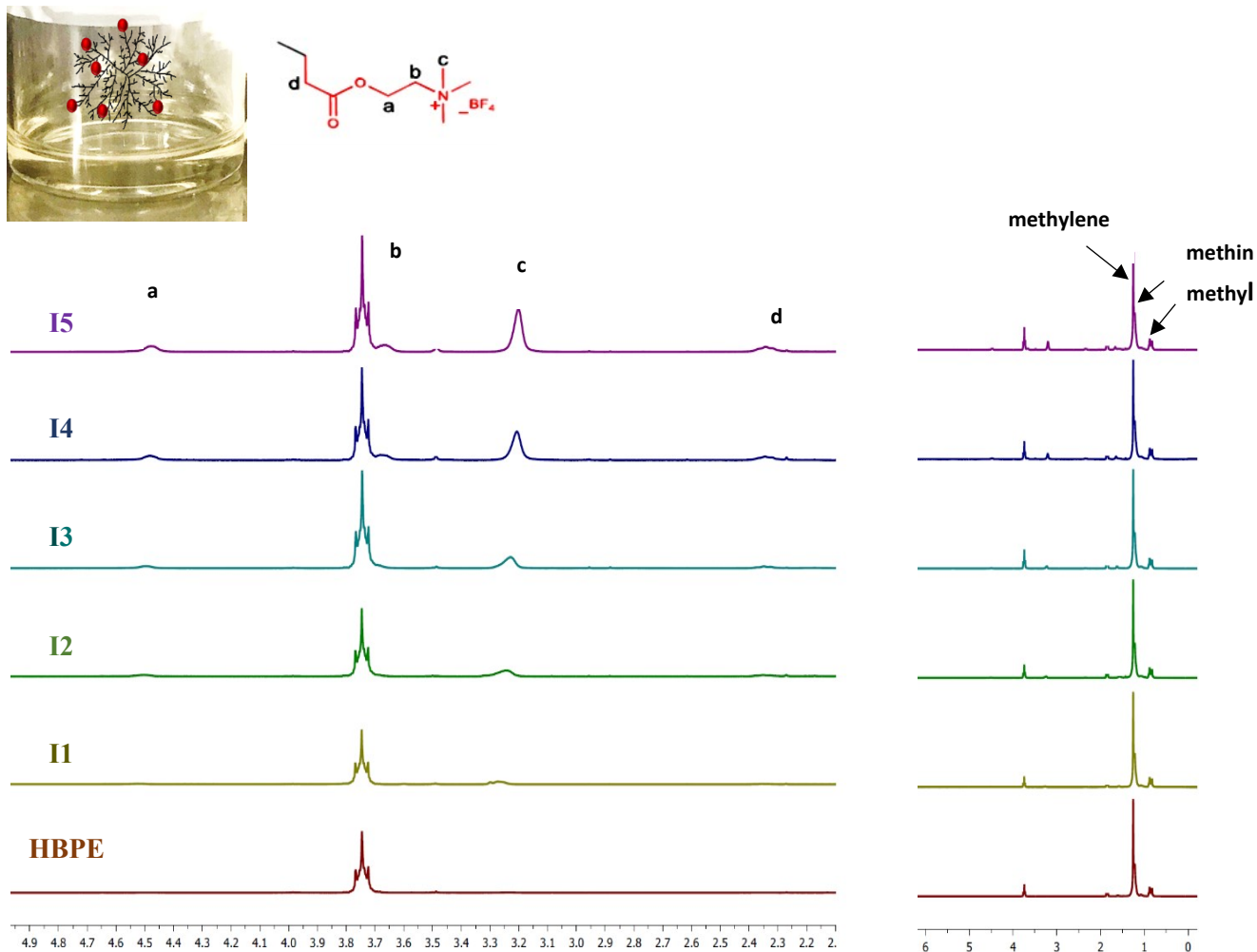


Figure S1. ¹H NMR spectra of the quaternary ammonium-containing hyperbranched polyethylene ionomers (I1–I5) and a nonionic hyperbranched polyethylene homopolymer.

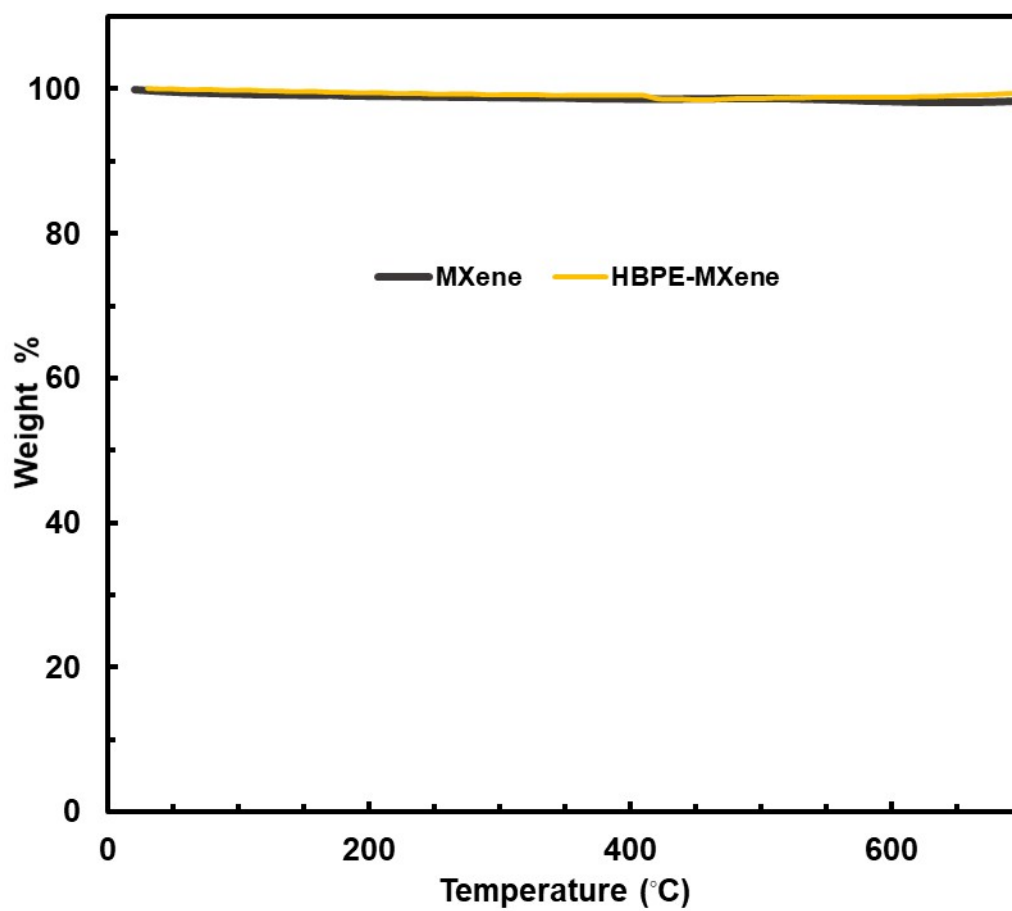


Figure S2. TGA curves of dried unmodified MXene and MXene modified with a nonionic hyperbranched ethylene homopolymer (HBPE).



Figure S3. Water contact angle measurements on films of $\text{Ti}_3\text{C}_2\text{T}_x$ MXene and I-MXene-4-2.

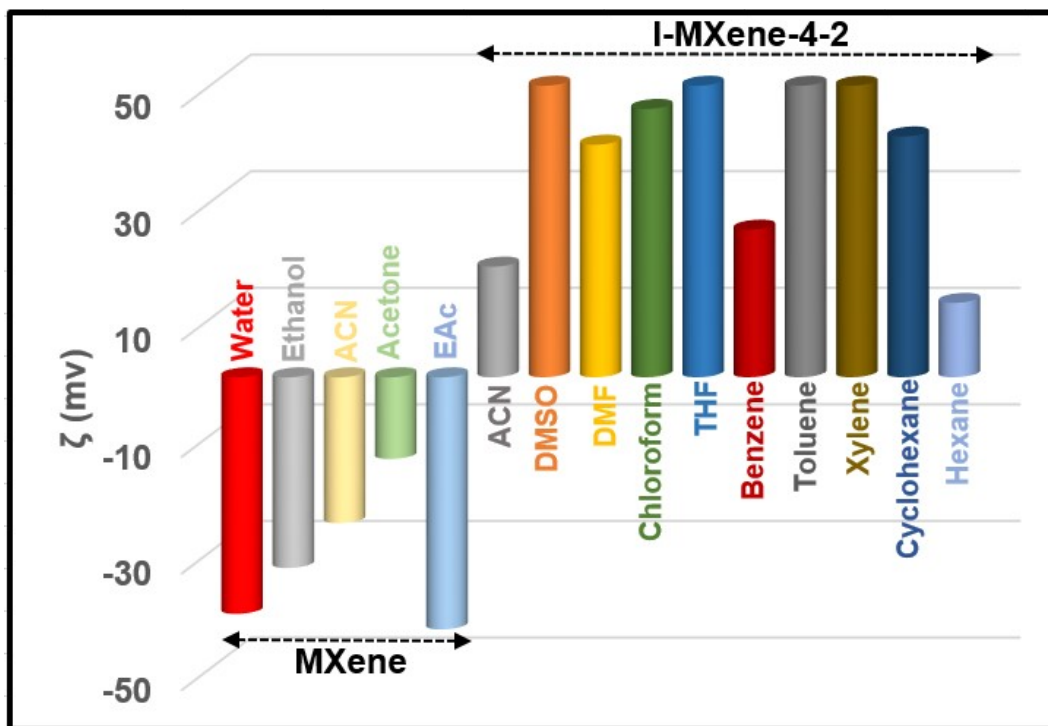


Figure S4. ζ potential results of MXene and I-MXene-4-2 in different solvents after 100 days.

Table S1. Physical-chemical properties of solvents used in this study^{1,2}

Solvent	Formula	Boiling Point (°C)	Density (g/mL) (at 20°C)	Solubility in H ₂ O ^a (g/100mg)	Relative Polarity ^b	Refractive index (at 20°C)	Viscosity (cP) (at 25°C)	Dielectric Constant
Water	H ₂ O	100	0.998	M	1	1.333	0.891	80.1
Methanol	CH ₄ O	64.6	0.791	M	0.762	1.329	0.544	32.7
Ethanol	C ₂ H ₆ O	78.5	0.789	M	0.654	1.36	1.04	24.5
Acetonitrile	C ₂ H ₃ N	81.6	0.786	M	0.460	1.344	0.369	36.64
DMSO	C ₂ H ₆ OS	189	1.092	M	0.444	1.479	1.987	47.24
DMF	C ₃ H ₇ NO	153	0.994	M	0.386	1.4305	0.92	36.7
Acetone	C ₃ H ₆ O	56.2	0.786	M	0.355	1.359	0.306	21.01
Pyridine	C ₅ H ₅ N	115.5	0.982	M	0.302	1.5093	0.88	12.4
Chloroform	CHCl ₃	61.2	1.498	0.8	0.259	1.445	0.537	4.81
Ethyl acetate	C ₄ H ₈ O ₂	77.1	0.902	8.7	0.228	1.372	0.423	6.08
THF	C ₄ H ₈ O	66	0.886	30	0.207	1.407	0.456	7.52
Benzene	C ₆ H ₆	80.1	0.879	0.18	0.111	1.501	0.603	2.28
Toluene	C ₇ H ₈	110.6	0.867	0.05	0.099	1.496	0.560	2.38
Xylene	C ₈ H ₁₀	138.5	0.864	0.02	0.074	1.497	0.59	2.57
Hexane	C ₆ H ₁₄	69	0.655	0.0014	0.009	1.375	0.300	1.89
Cyclohexane	C ₆ H ₁₂	80.7	0.779	0.005	0.006	1.4262	0.9	2.02

^a M indicates miscible.

^b The values for relative polarity extracted from *Christian Reichardt, Solvents and Solvent Effects in Organic Chemistry*, Wiley-VCH Publishers, 3rd ed., **2003**.

Table S2. Hansen ^{3,4} and Hildebrand solubility ⁴ parameters of the solvents used in this study.

Solvent	Formula	Δd^a (MPa ^{1/2})	δp^b	δh^c	Hildebrand (MPa ^{1/2})	Hydrogen- bonding capability
Water	H ₂ O	15.5	16	42.3	47.9	strong
Methanol	CH ₄ O	15.1	12.3	22.3	29.6	strong
Ethanol	C ₂ H ₆ O	15.8	8.8	19.4	26	strong
Acetonitrile	C ₂ H ₃ N	15.3	18	6.1	24.3	poor
DMSO	C ₂ H ₆ OS	18.4	16.4	10.2	24.5	moderate
DMF	C ₃ H ₇ NO	17.4	13.7	11.3	24.8	moderate
Acetone	C ₃ H ₆ O	15.5	10.4	7	20.2	moderate
Pyridine	C ₅ H ₅ N	19	8.8	5.9	21.9	strong
Chloroform	CHCl ₃	17.8	3.1	5.7	19	poor
Ethyl acetate	C ₄ H ₈ O ₂	15.8	5.3	7.2	18.1	moderate
THF	C ₄ H ₈ O	16.8	5.7	8	18.6	moderate
Benzene	C ₆ H ₆	18.4	0	2	18.8	poor
Toluene	C ₇ H ₈	18	1.4	2	18.2	poor
Xylene	C ₈ H ₁₀	17.6	1	3.1	18	poor
Hexane	C ₆ H ₁₄	14.9	0	0	14.9	poor
Cyclohexane	C ₆ H ₁₂	16.8	0	0.2	16.8	poor

^a Dispersive

^b Polar

^c H-bond

Polypropylene and polyethylene have $\delta D=18$, $\delta P=0$, $\delta H=1$, and $\delta D=16.9$, $\delta P=0.8$, $\delta H=2.8$ respectively. ^{3,4}

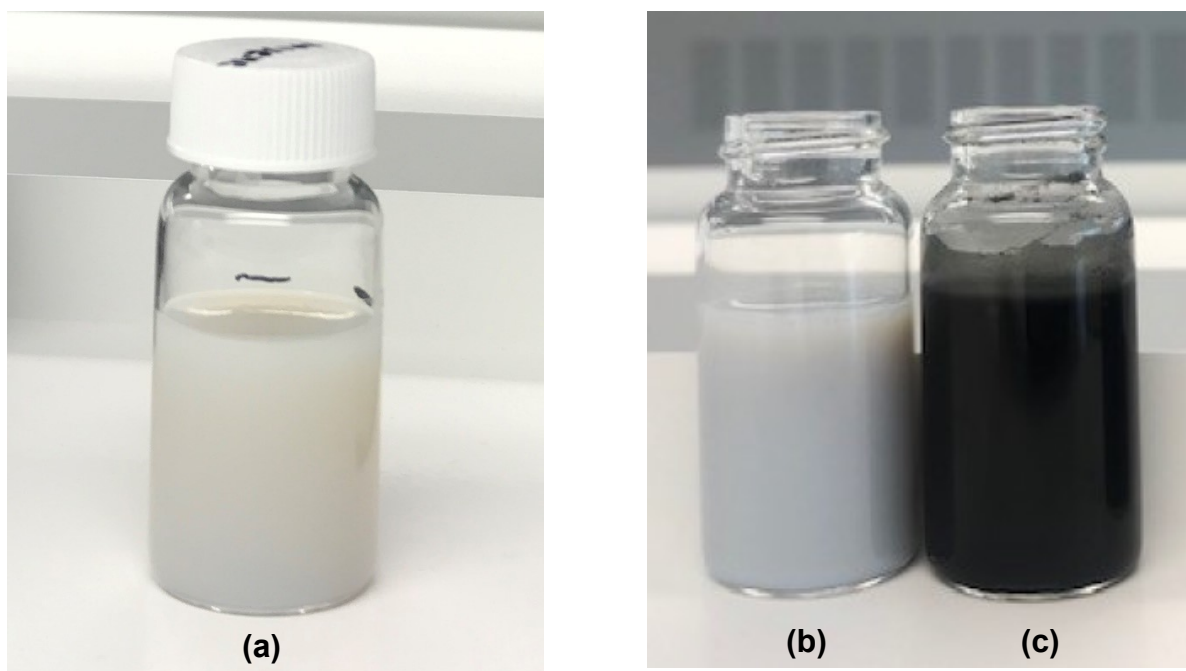


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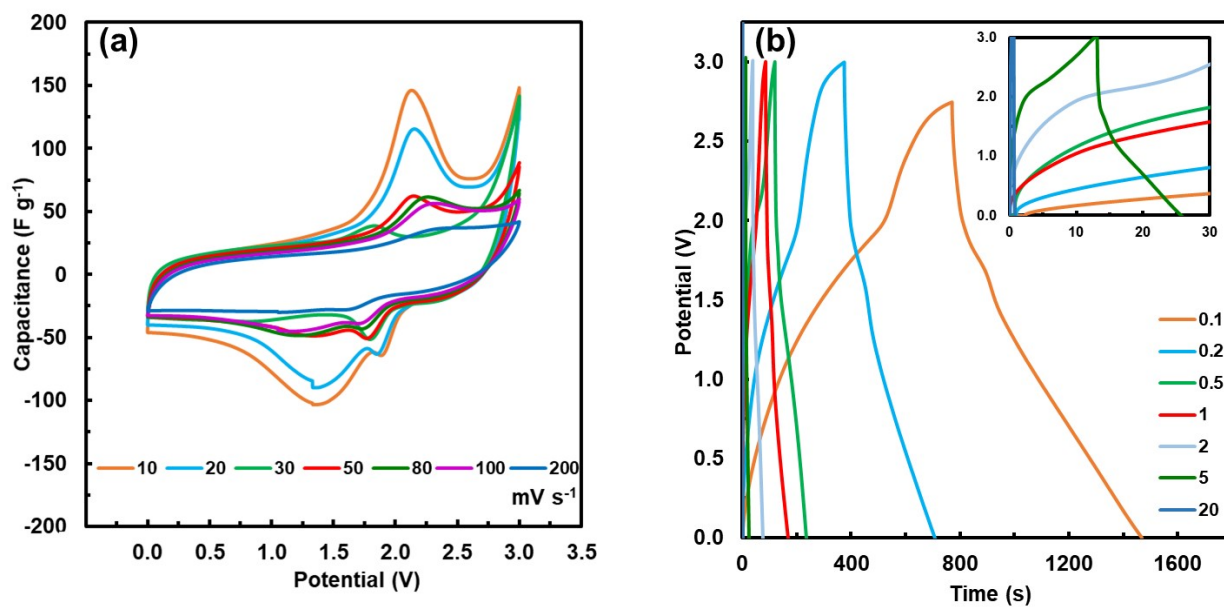


Figure S6. (a) CV curves of MXene device at different scan rates; (b) GCD curves of MXene device at various current densities.

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